ANNUAL COMPLIANCE REPORT

Instream Flow Agreement
for the
Cedar River

Cedar River Habitat Conservation Plan Year 8
January 1 through December 31, 2008

Prepared by

City of Seattle

Seattle Public Utilities
and
Seattle City Light

April 9, 2009

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Acknowledgements

In 2008 Cedar River Instream Flow Commission members again devoted substantial time and effort to help manage water resources in the Cedar River basin. Commission members also helped guide the development and implementation of complex supplemental studies and other technical analyses that continue to inform their management recommendations. The Commission members are herein recognized for their continued commitment to effectively manage water resources in the Cedar River basin and provide beneficial conditions for instream resources.

Organizational membership and representation is as follows:
Voting Organizations:

- National Marine Fisheries Service
  - Tom Sibley
  - Jim Muck
- United States Fish and Wildlife Service
  - Tim Romanski
- Washington Department of Fish and Wildlife
  - Mark Hunter
- Washington Department of Ecology
  - Jay Cook
- Muckleshoot Indian Tribe
  - Holly Coccoli
- City of Seattle
  - Liz Ablow – Seattle City Light
  - Karl Burton – Seattle Public Utilities
  - Alan Chinn – Seattle Public Utilities
  - Tom Fox– Seattle Public Utilities
  - Tom Johanson – Seattle Public Utilities
  - Rand Little – Seattle Public Utilities

Non-Voting Organizations:

- Army Corp of Engineers
  - Lynn Melder
  - Larry Schick
- King County
  - Steve Hirschey
  - Dave Monthie

In addition, it is recognized that it takes many people in an organization to translate good intentions into successful operations. Providing beneficial conditions for fish and other instream resources in the Cedar River is a 24-hour – 365-day a year responsibility.

Special thanks go to staff from:

- Cedar Falls Headworks (Seattle City Light)
- Water Supply and Treatment Section (Landsburg Operators and Control Center)
- Water Operations Planning and System Control Section
- Watershed Management Division
- Water Resources Section

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1. Introduction

The City of Seattle ("City") influences river flows in the Cedar River through its water supply and hydroelectric operations within the municipal watershed. Water from the Cedar River is used by about two-thirds of the City's 1.3 million customers in King and Snohomish Counties. The objective of the Cedar River Instream Flow Agreement (IFA), one of several agreements that establish the provisions of the Cedar River Watershed Habitat Conservation Plan (HCP), is to provide highly beneficial conditions for instream resources, while preserving Seattle's water supply and power generation capabilities.

The IFA establishes an inter-agency body, the Cedar River Instream Flow Oversight Commission ("Commission"), to assist the City in carrying out its river management responsibilities. The Commission was first convened in July 2000, and has met, on average, every month since then. Meetings are chaired by SPU and have been very well attended.

1.1 Purpose of Report

Seattle Public Utilities and Seattle City Light, for the City of Seattle, present this report to the Commission as documentation of compliance with flow requirements established in the 2000 Instream Flow Agreement (IFA) for the Cedar River. The IFA is part of the City's Cedar River Watershed Habitat Conservation Plan (HCP). Section D.3 (a) of the IFA stipulates that an annual compliance report be submitted to the Commission. This annual report covers the period January 1, 2008 through December 31, 2008.

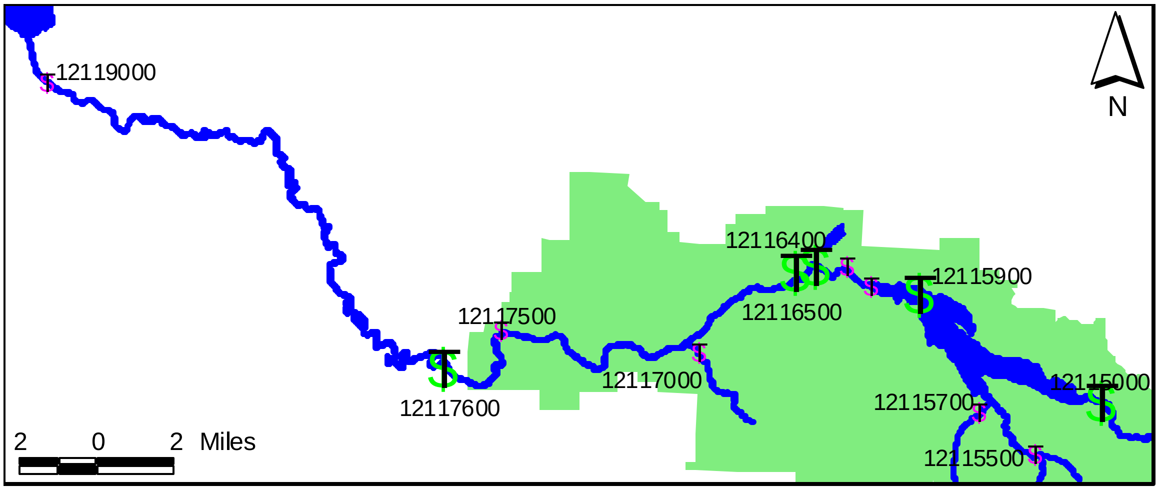
1.2 Summary

Highlights in 2008:

- All supplemental flows goals were met or exceeded.
- All downramping rates below Masonry Dam, Cedar Falls Powerhouse and Landsburg were met. On June 9, 2008 emergency bypass equipment at Cedar Falls did not function properly causing a sudden drop in flows within specified critical downramping flow ranges.
- The average annual Cedar River diversion = 77.4 MGD.
- The emigration of juvenile Chinook and sockeye salmon in the spring of 2008 was relatively robust, due in part to the fact that no large peak flow events occurred during the incubation period for these species. Preliminary estimates from the Washington Department of Wildlife indicate that the egg to emigration survival for these species was the highest since enumeration began in the 1990s.
- The number of spawning steelhead (*Oncorhynchus mykiss*) returning to the river in the spring of 2008 remained at low levels; resident/adfluvial *O. mykiss* populations appear to remain relatively robust.

2. Measuring Points

Flow and downramping compliance is measured at several locations throughout the Cedar River Watershed including:



USGS Gaging Station 12117600 – Cedar River below Diversion near Landsburg, Washington. Located at River Mile 20.4, this gage measures regulated streamflow downstream of Landsburg Diversion Dam. This is the measuring point for flows and downramping rates immediately below the Landsburg Diversion Dam, as required in Section B and sub-section C.2.c in the IFA.

Seattle Public Utilities Diversion – Cedar River at the Diversion Dam near Landsburg, Washington. Located at River Mile 21.9, this measures the volume of water (millions of gallons per day) diverted for municipal use and is monitored at the Landsburg Diversion Dam Facility.

USGS Gaging Station 12116500 – Cedar River at Cedar Falls, Washington. Located at River Mile 33.2, immediately below the Cedar Falls Powerhouse, this gage measures regulated streamflow downstream of the Cedar Falls Powerhouse. This is the measuring point for downramping rates immediately below the Powerhouse at Cedar Falls, as required in sub-section C.2.b in the IFA.

USGS Gaging Station 12116400 – Cedar River at Powerhouse at Cedar Falls, Washington. Located at River Mile 33.7, this gage is immediately upstream of the Cedar Falls Powerhouse and measures regulated streamflow downstream of Masonry Dam. This is the measuring point for flows and downramping rates immediately above the Cedar Falls Powerhouse, as required in sub-section C.1.a in the IFA. (Note: Date of installation Oct. 1, 2001).

USGS Gaging Station 12115900 – Chester Morse Lake at Cedar Falls, Washington This gage located at the Overflow Dike at River Mile 37.2 and measures water surface elevation of Chester Morse Lake. This is the measuring point for determining reservoir elevation, as required in sub-sections B.7.b. (1) and B.8.c. (1).

USGS Gaging Station 12115000 – Cedar River near Cedar Falls, Washington. This gage located at River Mile 43.5 and measures unregulated inflows to Chester Morse Lake. This is the measuring point for determining reservoir inflows, as required in sub-sections B.7.b. (2), B.7.b. (3), and B.8.c. (2), and serves as an index for total reservoir inflow.

3. Instream Flows Below Landsburg Diversion Dam

In accordance with the IFA Section B.1.a, the City has two types of commitments:

"consist of two types of commitments by the City. The minimum instream flows or volumes, as described in sub-sections B.2., B.4., B.6., B.7., and B.8., represent requirements of the City and are referred to as "firm" flows or volumes, subject to the specific conditions and procedures set forth therein. Additional flows or volumes provided to supplement minimum flows, as described in sub-sections B.3. and B.5., represent goals of the City and are referred to as "non-firm" flows or volumes, subject to the specific conditions and procedures set forth therein."

This section is provided to indicate the level of compliance with the City's instream flow requirements and goals set forth in the IFA.

3.1 Minimum Instream Flows Below Landsburg Dam

Compliance with minimum flow requirements is assessed at one monitoring location within the Cedar River Watershed: USGS Gage 12117600 - Cedar River below Diversion near Landsburg

3.1.1 Requirements

Required minimum flows are specified in Section B.2.c in the IFA.

3.1.2 Compliance

During the reporting period, the project was in compliance with the IFA for minimum flow at USGS Gage 12117600. See Figure 8.1 and Tables 8.1 and 8.2. For long-term tracking purposes, stream flows have remained at or above normal minimum levels at all times in HCP Years 1 through 8.

3.2 Non-Firm Flow Supplemental Flow in Late Winter and Early Spring for Sockeye Outmigration

3.2.1 Goals

Flow requirements are specified in Section B.3.a in the IFA:

"Between February 11 and April 14, the City will, as a goal, expect to supplement the normal minimum instream flows listed in sub-section B.2.c. by 105 cfs at least 70% of the time throughout said period in any year in which normal flows are in effect throughout said period."

3.2.2 Compliance

The City met and exceeded the goal this year by providing more than 105 cfs of supplemental flow 100% of time. See Tables 3.2.1.

Table 3.2.1

Calendar Dates	Required Minimum Instream Flows, cfs	Minimum Instream Flows Plus Non-Firm Supplemental Flows, cfs	Lowest Recorded Mean Daily Flow for the Period, cfs
Feb 11 - Feb 17	260	365	839
Feb 18 - Feb 24	260	365	656
Feb 25 - Mar 3	260	365	645
Mar 4 - Mar 10	260	365	711
Mar 11 - Mar 17	260	365	564
Mar 18 - Mar 24	260	365	547
Mar 25 - Mar 31	260	365	383
Apr 1 - Apr 7	260	365	382
Apr 8 - Apr 14	260	365	419

For long-term tracking, this goal has been met or exceeded in 6 of 8 years

3.3 Firm Block of Water in Early Summer to Supplement Normal Minimum Flows for Steelhead Incubation

3.3.1 Requirements

Flow requirements are specified in Section B.4 in the IFA:

"Between June 17 and August 4, in addition to the normal minimum flows listed in subsection B.2.c., the City shall provide such supplemental flow volumes as the Commission may direct, provided that the total volume of such supplemental flows shall not exceed 2500 acre feet of water, and that other procedures and conditions in this sub-section B.4. are met."

3.3.2 Compliance

The City provided the Firm Block as prescribe by the Commission. See Tables 3.3.1 and 8.1 and Figure 8.1.

Table 3.3.1

Calendar Dates	Required Minimum Instream Flows, cfs	Required Minimum Flow plus 2008 Summer Supplemental Firm Block, cfs	Lowest Recorded Mean Daily Flow for the Period, cfs
Jun 17 - Jun 30	225	225	689
July 1 - July 7	170	170	818
Jul 8 - Jul 14	105	160	271
Jul 15 - Jul 18	80	160	227
Jul 19 - Jul 23	80	130	194
Jul 24 - Jul 28	80	115	192
Jul 29 - Aug 1	80	105	182
Aug 2 - Aug 4	80	90	241

For long-term tracking, this goal has been met or exceeded in all years.

3.4 Non-Firm Block of Water in Early Summer to Supplement Normal Minimum Flows for Steelhead Incubation

3.4.1 Goals

Flow requirements are specified in Section B.5 in the IFA:

"Between June 17 and August 4, in addition to the normal minimum flows listed in sub-section B.2.c, and the "firm block" described in sub-section B.4., the City will, as a goal and under the conditions set forth in this sub-section B.5., expect to further supplement normal minimum flows by 3500 acre feet of "non-firm" water in 63% of all years."

3.4.2 Compliance

The City offered and the Commission allocated the full 3,500 Acre-Feet block. See Tables 3.4.1 and 8.1 and Figure 8.1.

Table 3.4.1

Calendar Dates	Required Minimum Instream Flows, cfs	Required Minimum Flow plus 2008 Summer Supplemental Firm and Non-Firm Blocks, cfs	Lowest Recorded Mean Daily Flow for the Period, cfs
Jun 10 - Jun 16	225	225	1370
Jun 17 - Jun 30	225	240	689
July 1	170	240	818
July 2 - July 7	170	235	818
July 8	105	235	719
July 9 - July 14	105	200	271
July 15 - July 20	80	200	219
July 21 - July 25	80	175	194
July 26 - July 28	80	150	192
July 29 - July 31	80	130	182
Aug 1 - Aug 3	80	110	219
Aug 4	80	95	247

For long-term tracking purposes, SPU has offered the full non-firm block in eight out of nine years; the Commission declined allocation of the block in one year; the full non-firm block has been provided in seven out of nine years (78%).

3.5 Higher Normal and Critical Minimum Flows in September for Sockeye and Chinook Spawning

3.5.1 Requirements

Flow requirements are specified in Section B.6 in the IFA.

In any year in which the temporary flashboards, as they presently exist in the City's Overflow Dike or may hereafter be reconstructed, are in place throughout the period of June 1 through September 30, the normal minimum flows listed in sub-section B.2.c. shall be increased by the amount of 38 cfs between September 15 and 22, and by the amount of 115 cfs between September 23 and 30, and the critical minimum flows shall be increased by the amount of 10 cfs through the period between September 1 and 15

3.5.2 Compliance

Temporary flashboards were in place throughout the period June 1 through September 30, 2008 and the City provided the additional flows. See Tables 3.5.1 and 8.1 and Figure 8.1.

Table 3.5.1

Calendar Dates	Required Minimum Instream Flows, cfs	Minimum Instream Flows Plus Higher Normal Minimum Flows, cfs	Lowest Recorded Mean Daily Flow for the Period, cfs
Sep 16 - Sep 22	95	133	144
Sep 23 - Sep 30	95	210	226

For long term tracking, increased normal flows have been provided at all times during this period in HCP Years 1 through 8.

3.6 Two-Part Normal Minimum Flow Regime in the fall for Sockeye and Chinook Spawning

3.6.1 Requirements

Flow requirements are specified in Section B.7 in the IFA:

"Between October 8 and December 31, the City shall provide either high-normal minimum flows of 330 cfs or low-normal minimum flows of 275 cfs, except when flows are reduced to critical minimum flows under the terms of sub-section B.8. More specifically, the City, beginning on October 8, will meet the high-normal and low-normal flow regimes with the following long-term average frequencies assuming that the critical minimum flow regime will be in effect at a long-term average frequency of one of ten years:

(1) The City will follow the <u>high-normal</u> minimum flow regime in six of ten years, provided that it may switch down to low-normal in one of those years when actual or forecasted water availability conditions worsen significantly from those projected and understood at the time of the decision to provide high-normal minimum flows.

(2) The City may follow the <u>low-normal</u> minimum flows in three of ten years, provided that it will switch up to high-normal at such time after October 8 if the City determines that improving conditions allow, or when criteria for high-normal are met, whichever comes first."

3.6.2 Compliance

The City provided high-normal minimum flows exceeding 330 cfs from October 8 through December 31, 2008, during the expected peak of the sockeye and Chinook spawning season. See Table 8.1 and Figure 8.1.

For long term tracking purposes, the following table, Table 3.6.1 compares expected with actual performance (expressed as percentage of all years).

Table 3.6.1

Week Period	Actual 2007	Expected		Actual 00-08	
		High %	Low %	High %	Low %
Oct 8 - Oct 14	High	60	30	89	11
Oct 15 - Oct 21	High	60	30	100	0
Oct 22 - Oct 28	High	60	30	89	11
Oct 29 - Nov 4	High	50	40	89	11
Nov 5 - Nov 11	High	55	35	89	11
Nov 12 - Nov 18	High	65	25	89	11
Nov 19 - Nov 25	High	65	25	89	11
Nov 26 - Dec 2	High	70	20	89	11
Dec 3 - Dec 9	High	75	15	89	11
Dec 10 - Dec 16	High	75	15	89	11
Dec 17 - Dec 23	High	80	10	89	11
Dec 24 - Dec 30	High	80	10	89	11

3.7 Reductions to Critical Minimum Flows

3.7.1 Requirements

Required minimum flows are specified in Section B.8 in the IFA:

"This sub-section describes the circumstances under which the Parties agree that the City may switch to the minimum flow levels indicated in the column headed "Critical Flows" in the table which appears in sub-section B.2.c., until such time as those criteria may be modified pursuant to section E.4."

3.7.2 Compliance

The City did not switch to the critical flow levels at any time during the reporting period. See Table 8.1 and Figure 8.1. For long-term tracking purposes, stream flows have not been reduced to critical levels at any time during HCP Years 1 through 8.

4. Instream Flows Above Landsburg Diversion Dam

4.1 Flows between Cedar Falls Powerhouse and Masonry Dam

Compliance with minimum flow requirements is assessed at one monitoring location within the Cedar River Watershed: USGS Gage 12116400 - Cedar River at Powerhouse near Cedar Falls

4.1.1 Requirements

Required minimum flows are specified in Section C.1.a in the IFA:

"After construction of a fish ladder at Landsburg Diversion Dam and subsequent upstream passage of selected species of anadromous fish, the City will provide a minimum flow of 30 cfs on a continuous basis to protect rearing habitat in the Cedar River "Canyon Reach," measured by a new USGS stream gage to be installed near river mile 33.7 and funded by the City "

Fish ladder was completed and operational September 1, 2003. The first anadromous fish passed above Landsburg Diversion Dam on September 19, 2003, which marks the date the City will start to provide a minimum flow of 30 cfs on a continuous basis in the Cedar River "Canyon Reach."

4.1.2 Compliance

During the reporting period, the project was in compliance with the IFA for minimum flow at USGS Gage 12116400. See Table 8.4 and Figure 8.6. For the purposes of long-term complinace mean daily stream flows at this location have remained above 30 cfs at all times since completing construction of the Landsburg Fish Passage Facility on September 1, 2003.

5. Downramping below City Facilities

5.1 Downramping below Landsburg Diversion Dam

5.1.1 Requirements

Section C.2.c in the IFA:

"(b) The measuring point for downramping rates at the Landsburg Diversion Dam will be the existing USGS gage number 12117600 located below the Dam at river mile 20.4. Not later than the end of HCP Year 2, the City will install equipment to monitor this gage on a "real time" basis. For compliance purposes, specific ramping rate values set forth in this sub-section C.2.c. will be calculated from provisional real time data and gage error, as determined by USGS, shall be factored into the ramping rate calculation.

(c) The downramping rates and prescriptions set forth in this sub-section C.2.c. will not apply when flows exceed 850 cfs.

(2) Downramping During Normal Operations

(a) Between February 1 and October 31, the maximum downramping flow rate will be one inch per hour.

(b) Between November 1 and January 31, the maximum downramping flow rate will be two inches per hour.

(c) The tainter gates will be down and closed during normal operations.

(3) Downramping During Startup Following Full System Shutdown

(a) Based on past experience, full system shutdown at flows less than 850 cfs can be expected to occur one to two times per year for scheduled and unscheduled maintenance, and at least once per year for forebay cleaning. Shutdowns for construction may also occur depending on the nature of the construction project.

(b) To minimize risk of cavitation and mechanical damage of equipment at Landsburg Diversion Dam, initial downramping following full system shutdown will be at a maximum of 60 cfs per hour."

5.1.2 Compliance

During the reporting period, the project was in compliance with the IFA for downramping below Landsburg at USGS Gage 12117600. See Figures 8.2 and 8.3.

On June 9, the emergency bypass equipment did not function properly during an emergency plant shutdown at the Cedar Falls Hydroelectric Project resulting in a sudden drop in flows. The event included a period of decline, within specified critical downramping flow ranges, that was greater than target maximum downramping rates at USGS Gage 12116500 and USGS Gage 12117600. As per Section C.3.a of the IFA, downramping rate prescriptions established in Sections 5.2.1 and 5.1.1 above do not apply to emergency plant shutdown. According to Section C.3.a Emergency Bypass Capability:

> *"In early 1999, the City installed, tested and implemented operating procedures for new equipment to provide bypass flows around its hydroelectric turbines during most emergency plant shutdowns to protect against stranding of fish and dewatering of redds as a result of such events."*

In support of Section C.3.a, Seattle has continued to implement a number of facility and operational improvements to reduce the frequency and magnitude of flow declines during emergency plant shutdown of the Cedar Falls Hydroelectric Project. Although the June 9 event does not constitute a formal downramping exceedence, the event was reported to the IFC and corrective measures have been implemented to provide safeguards against this type of flow event happening in the future. Please see description of the event in Section 6.

5.2 Downramping below Cedar Falls Powerhouse

5.2.1 Requirements

Section C.2.b in IFA:

"*(2) The measuring point for downramping rates at the Cedar Falls Powerhouse will be the existing USGS gage number 12116500 located ½ mile below the Powerhouse at river mile 33.2. For compliance purposes, specific ramping rate values set forth in this sub-section C.2.b will be calculated from provisional real time data and gage error, as determined by USGS, shall be factored into the ramping rate calculation.*

(3) The downramping rates and prescriptions set forth in this sub-section C.2.b will not apply when flows exceed 300 cfs

b. Downramping During Normal Operations

(1) Between February 1 and June 15, the maximum downramping flow rate will be two inches per hour with no daylight downramping (defined as one hour before sunrise until one hour after sunset).
(2) Between June 16 and October 31, the maximum downramping flow rate will be one inch per hour.
(3) Between November 1 and January 31, the maximum downramping flow rate will be two inches per hour.

c. Downramping during full system shutdown

(1) Based on past experience, full system shutdown at flows less than 300 cfs can be expected to occur one to two times per year due to low flow conditions or for scheduled and unscheduled maintenance or construction projects.
(2) When the lone unit is shutdown the wicket gates close at a prescribed speed (a condition of the machine safety mechanisms), which results in a sudden drop in flow, averaging a total of 25 cfs per occurrence.

d. Swapping load during daytime downramping restrictions

(1) During daytime downramping restrictions there may be a need to swap loads between generators. In most circumstances it is seamless and would not show up as a change in stage. However, there are situations in moving water from one machine to the other, due to the normal shutdown sequence, that can cause a sudden drop followed by an increase, or vice-versa. These are typically short duration occurrences.

e. Extended shutdowns during the February to June 15 time frame.

*(1) The City will notify the C*ommission *ahead of time of the circumstances that will require an extended shutdown and discuss the need for leniency on daytime downramping."*

5.2.2 Compliance

During the reporting period, the project was in compliance with the IFA for downramping below Cedar Falls Powerhouse at USGS Gage 12116500. See Figures 8.4 and 8.5

On June 9, the emergency bypass equipment did not function properly during an emergency plant shutdown at the Cedar Falls Hydroelectric Project resulting in a sudden drop in flows. The event included a period of decline, within specified critical downramping flow ranges, that was greater than target maximum downramping rates at USGS Gage 12116500 and USGS Gage 12117600. As per Section C.3.a of the IFA, downramping rate prescriptions established in Sections 5.2.1 and 5.1.1 do not apply to emergency plant shutdown. According to Section C.3.a Emergency Bypass Capability:

> *"In early 1999, the City installed, tested and implemented operating procedures for new equipment to provide bypass flows around its hydroelectric turbines during most emergency plant shutdowns to protect*

against stranding of fish and dewatering of redds as a result of such events."

In support of Section C.3.a, Seattle has continued to implement a number of facility and operational improvements to reduce the frequency and magnitude of flow declines during emergency plant shutdown of the Cedar Falls Hydroelectric Project. Although the June 9 event does not constitute a formal downramping exceedence, the event was reported to the IFC and corrective measures have been implemented to provide safeguards against this type of flow event happening in the future. Please see description of the event in Section 6.

5.3 Downramping below Masonry Dam

5.3.1 Requirements

Section C.2.a in IFA:

"(2) The measuring point for downramping rates at the Masonry Dam will be the USGS gage number 12116400 located below the Dam at river mile 33.7. For compliance purposes, specific ramping rate values set forth in this sub-section C.2.a will be calculated from provisional real time data and gage error, as determined by USGS, shall be factored into the ramping rate calculation.

(3) The downramping rates and prescriptions set forth in this sub-section C.2.a will not apply when flows exceed 80 cfs

b. Downramping During Normal Operations

(1) Between February 1 and October 31 the final maximum downramping flow rate between February 1 and October 31 will be one-inch per hour.
(2) Between November 1 and January 31, the maximum downramping flow rate will be two inches per hour."

5.3.2 Compliance

During the reporting period, the project was in compliance with the IFA for downramping flow at USGS Gage 12116400. See Figures 8.6 and 8.7.

6. Emergency Bypass Capability

6.1 Requirements

Section C.2.a in IFA:

In 1999, the City installed, tested and implemented operating procedures for new equipment to provide bypass flows around its hydroelectric turbines during most emergency plant shutdowns to protect against stranding of fish and dewatering of redds as a result of such events.

In its original configuration, the Cedar Falls Hydroelectric Project was not able to provide flow to the river during emergency shutdown of electrical generating equipment. To remedy this situation, in early 1999, the City installed equipment to provide bypass flows around its hydroelectric turbines during most emergency plant shutdowns. This original bypass system's flow capacity was limited to approximately 70 percent of the original flow passing through the generator prior to the load rejection. The city decided to expand the emergency bypass system's scope to improve the flow capacity through the bypass system. This work was completed in 2002 and has resulted in a more reliable system that has provided matching flow continuation to the river during most emergency shutdowns.

6.1 Compliance

During the reporting period, the project had four emergency plant shutdowns on June 9, June 10, June 14 and July 2.

Table 6.1. Emergency Bypass Capability

Date	Outcome	Note
June 9	Both units tripped off-line and only one of the units emergency bypass systems successfully provided flow continuation (though it was not a complete flow match) causing a substantial drop in flow in the river within specified critical downramping flow ranges.	(1)
June 10	One unit tripped off-line and emergency bypass system successfully provided complete flow continuation	
June 14	Both units tripped off-line and both units emergency bypass systems provided partial flow continuation.	(2)
July 2	Both Units tripped off-line. Both emergency bypass systems failed.	(3)

(1) There was a flow event that occurred June 9^{th}, 2008 at the Cedar Falls powerhouse in reaction to a PSE Twin Falls facility failure. Subsequent voltage and frequency swings pushed both Cedar Falls units to trip off-line and only one of the units emergency bypass systems successfully provided flow continuation though it was not a complete flow match from the unit. The second unit's emergency bypass system may have partially engaged but did not hold and resulted in a complete shutdown of 350 cfs in about 30 minutes. When the event occurred, the SCC had been downramping the Masonry Spill Valve at the dam, which compounded the flow reduction, which totaled 470 cfs in the first half hour and an additional 100 cfs over the next hour. When evaluated, the key reason the emergency bypass system did not operate as designed was a powerhouse electrical blackout, which resulted in a lack of power to run both the program logic coordinator (PLC) and the valves important to the emergency bypass system. The relief valve hydraulic pumps require AC and the PLC requires DC if there is a black out.

This event resulted in a total stage drop of 15.6 inches over 3 hours and 15 minutes at the USGS Gage at Cedar Falls and 9.6 inches over 2 hours and 15 minutes at the USGS Gage below Landsburg. Most of the flow drop occurred in higher flows above specified critical downramping flow ranges that was greater than target maximum downramping rates at USGS Gage 12116500 and USGS Gage 12117600. However, a small portion of the event occurred when flows were within the specified critical flow downramping range. At the Cedar Falls gage from 21:15 through 22:30 flows exceeded downramping rates of 2"/hr with a maximum exceedance of 2.6 in/hr. At the Landsburg Diversion gage from 22:30 through 23:45 for one 15 minute increment and from 6/10 0:45 through 1:45 for another 15-minute, increment declines in flows exceeded downramping rates of 1"/hr by 0.5 and 0.2 inches respectively. Operations at Landsburg help moderate the magnitude of the event below the Dam, but did not have the capacity to completely eliminate it.

Upgrading the Powerhouse DC Station/inverter which provides redundant electrical services and backup power to the plant systems, preventing generation outages was the main resolution identified. This upgrade was completed in the end of 2008. With the completion of the DC Stations/Inverter, more reliable operation of the emergency bypass system should occur which will prevent these types of sudden flow drops in the Cedar River.

(2) The DC system at the powerhouse was on a temporary battery system during plant upgrades and the voltage dropped to a point that caused the plant to trip off-line. The plant emergency bypass system only provided partial flow continuation because DC is required to match flows. The flow reduction that occurred was above specified critical downramping flow ranges at both USGS Gage 12116500 and USGS Gage 12117600. This type of event will be resolved with the DC Station/inverter upgrade.

(3) Severe local lightning caused both units to trip off-line while the Powerhouse DC Station/inverter upgrade work was being implemented. The emergency bypass system was not able to respond automatically because of the work that was in progress at the time. The operators were onsite and were able to provide flow continuation manually.

7. Municipal Water Use

7.1 Requirements

The HCP provides that "The City…is dedicated to managing water diversions from the Cedar for the next 5 to 10 years in the same range that water diversions have been for the last five years (98-105 mgd on an annual average basis)."

7.2 Compliance

The City was in compliance with the provision in 2008. Actual average annual water diversion in 2008 was 77.4 mgd. See Table 8.7.

7.3 Municipal Water Service Area

The retail service area remained the same, and no new wholesale customers were added in 2008.

8. Measurement and Reporting

Annual reports are provided to the Commission to evaluate the City's compliance with the terms of the Instream Flow Agreement Section D.3.a.

"The City will provide to the Commission, on an annual basis, the record of measurements from the locations listed in subsection D.1. Average daily flows and reservoir elevations will be provided to indicate compliance with minimum instream flow requirements and goals. A table will be provided to show flows at the measuring points compared to the critical, low-normal, high-normal, and non-firm flow levels as identified in section B. For periods affected by downramping operations, flow data will be provided in one-hour increments to indicate compliance with downramping prescriptions."

These flow and elevation records are described below.

Figure 8.1 – Instream Flows Below Landsburg Compliance Graph
Figure 8.2 – Downramping Flows Below Landsburg Compliance Graph
Figure 8.3 – Downramping Rate of Change Below Landsburg Compliance Graph
Figure 8.4 – Downramping Flows below Powerhouse Compliance Graph
Figure 8.5 – Downramping Rate of Change Below Powerhouse Compliance Graph
Figure 8.6 –Downramping Flows below Masonry Dam Compliance Graph
Figure 8.7 – Downramping Rate of Change Below Masonry Dam Compliance Graph

Table 8.1 – USGS 12117600 Mean Daily Flows
Table 8.2 – Instream Schedule with Firm and Non-Firm Flows
Table 8.3 – USGS 12116500 Mean Daily Flows
Table 8.4 – USGS 12116400 Mean Daily Flows
Table 8.5 – Seattle Public Utilities Chester Morse Lake Daily 7AM Elevation
Table 8.6 – USGS 12115000 Mean Daily Flows
Table 8.7 – Seattle Public Utilities Landsburg Daily Diversion
Table 8.8 – Seattle Public Utilities Landsburg 24 Hour Total Precipitation
Table 8.9 – Seattle Public Utilities Masonry Dam 24 Hour Precipitation

Figure 8.1 – Instream Flows Below Landsburg Compliance Graph

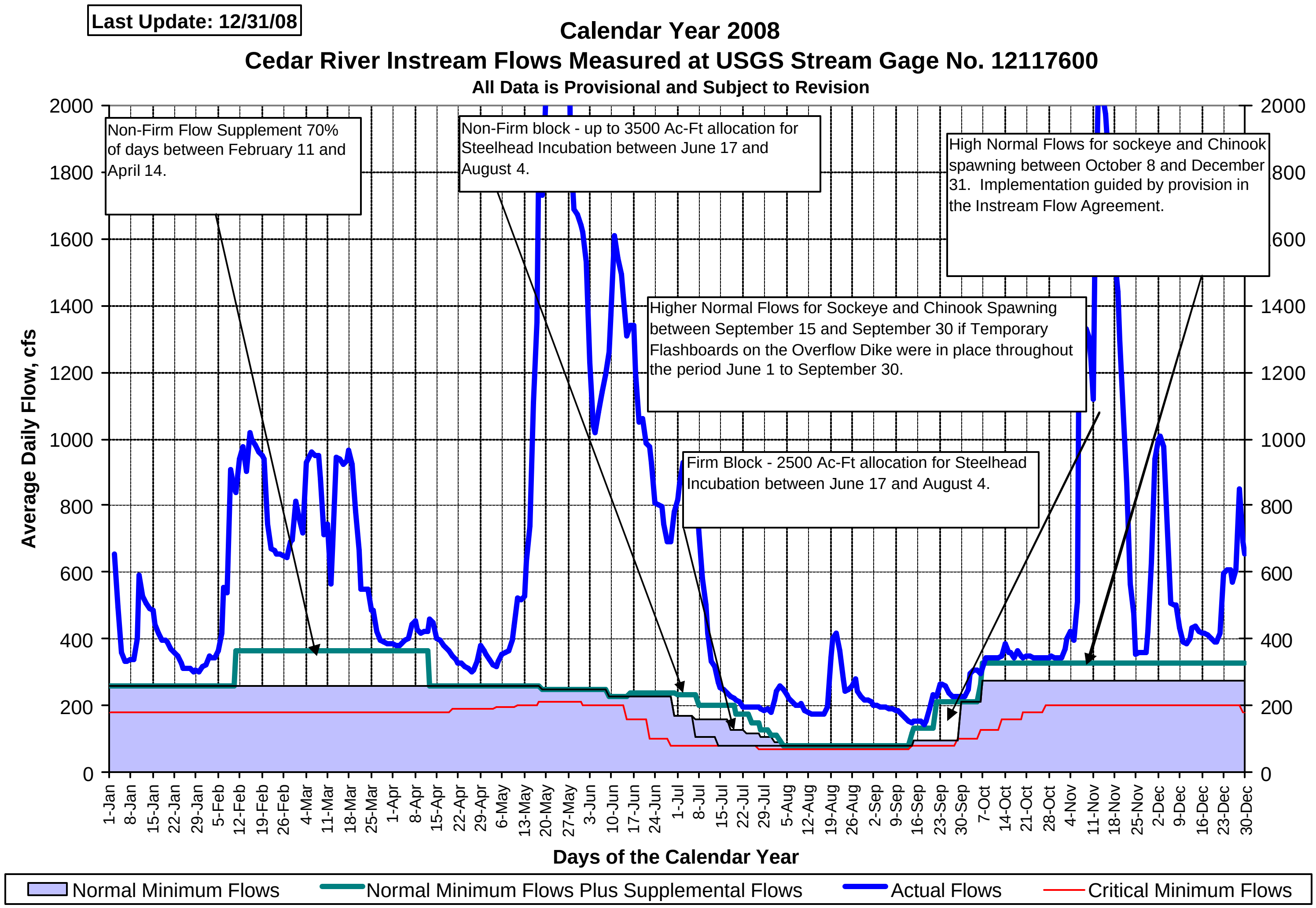


Figure 8.2 – Downramping Flows Below Landsburg Compliance Graph

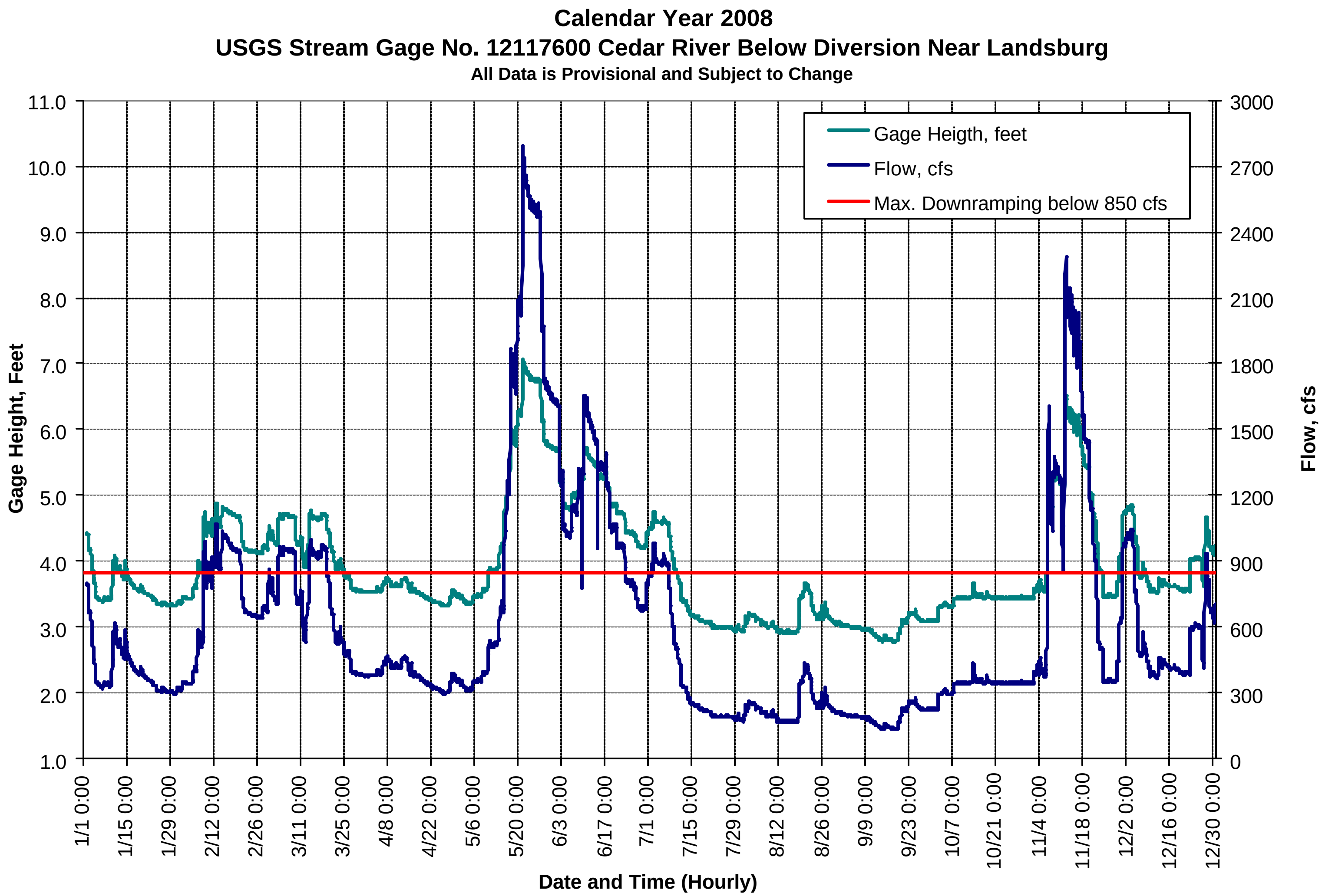


Figure 8.3 – Downramping Rate of Change Below Landsburg Compliance Graph

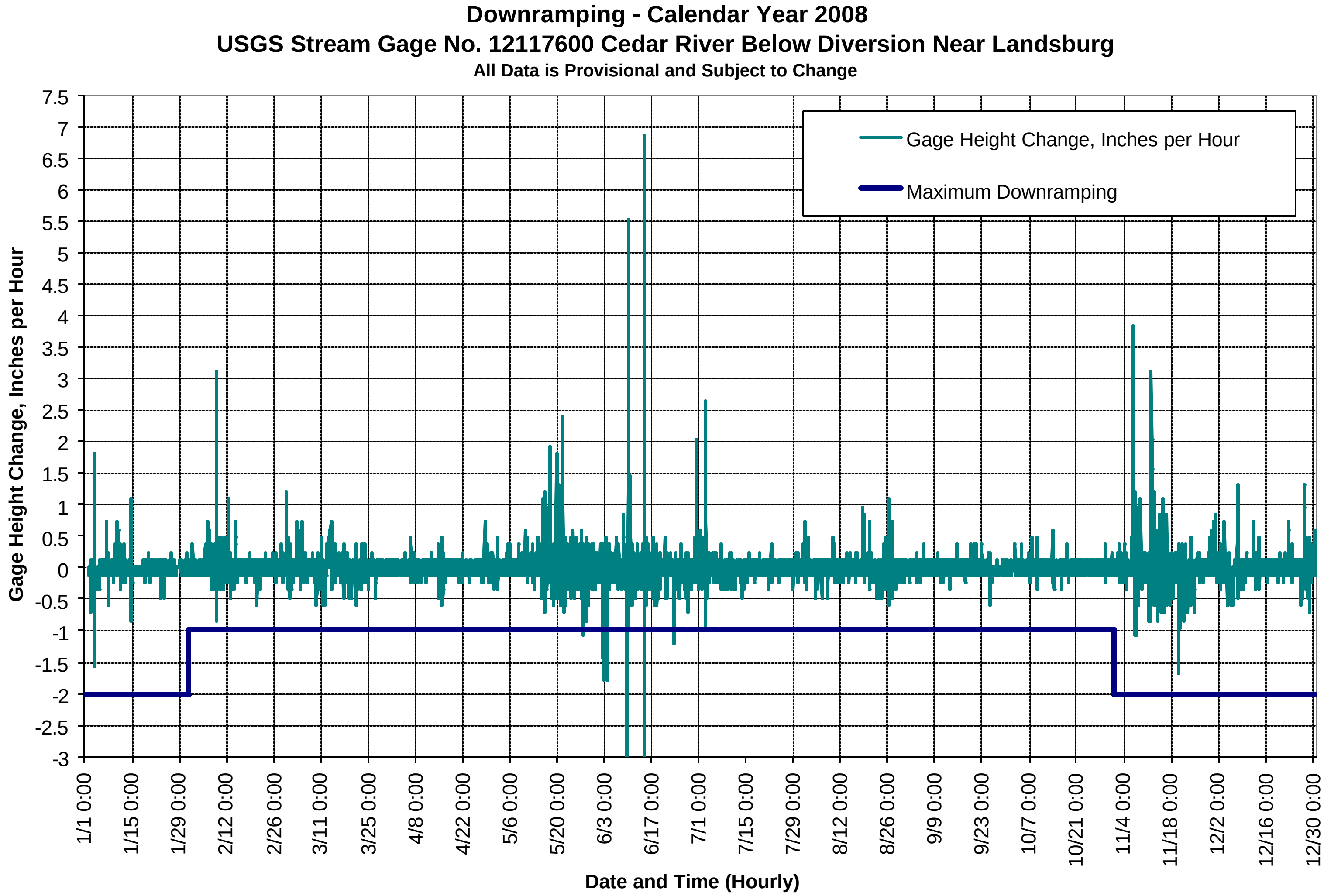


Figure 8.4 – Downramping Flows below Powerhouse Compliance Graph

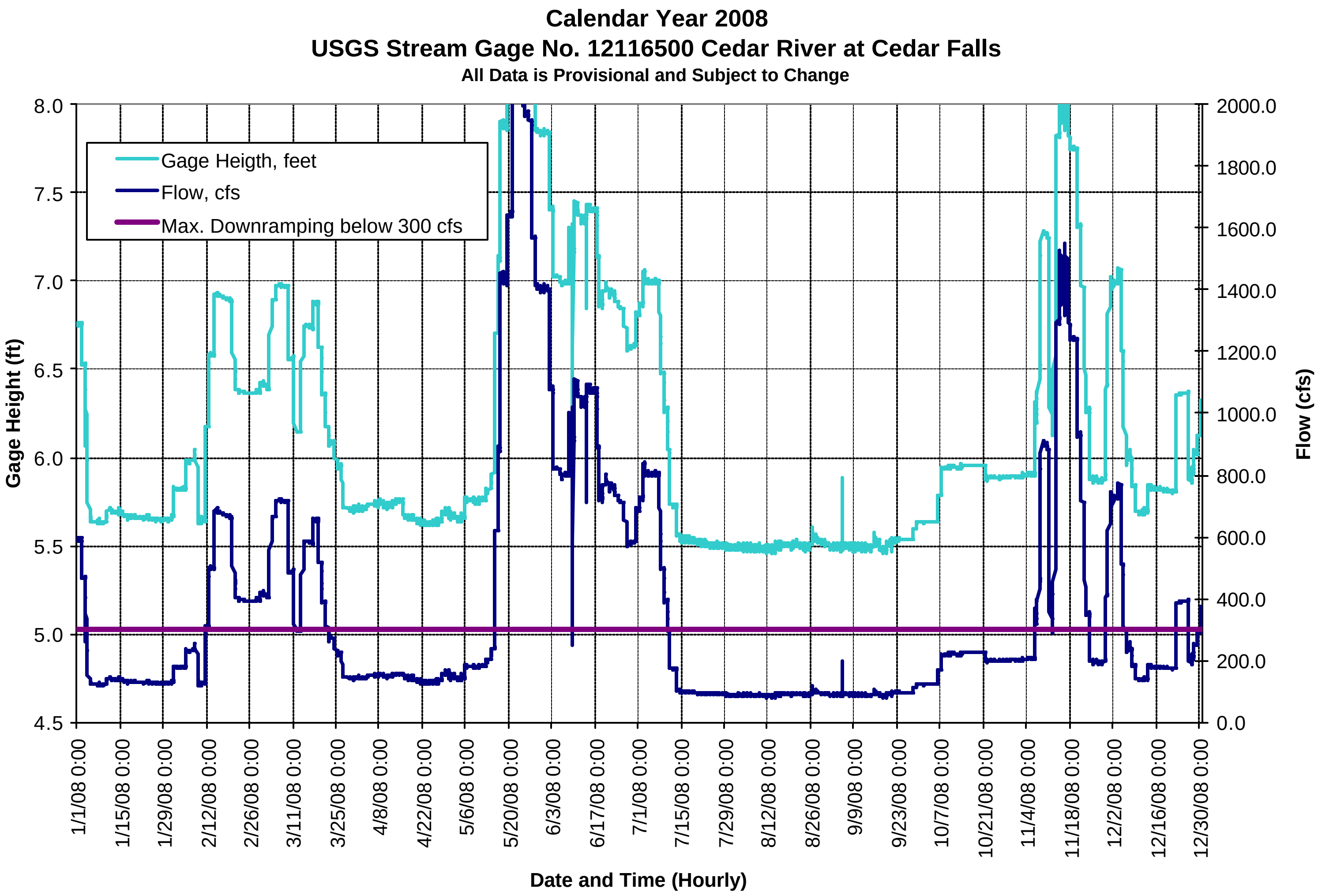


Figure 8.5 – Downramping Rate of Change Below Powerhouse Compliance Graph

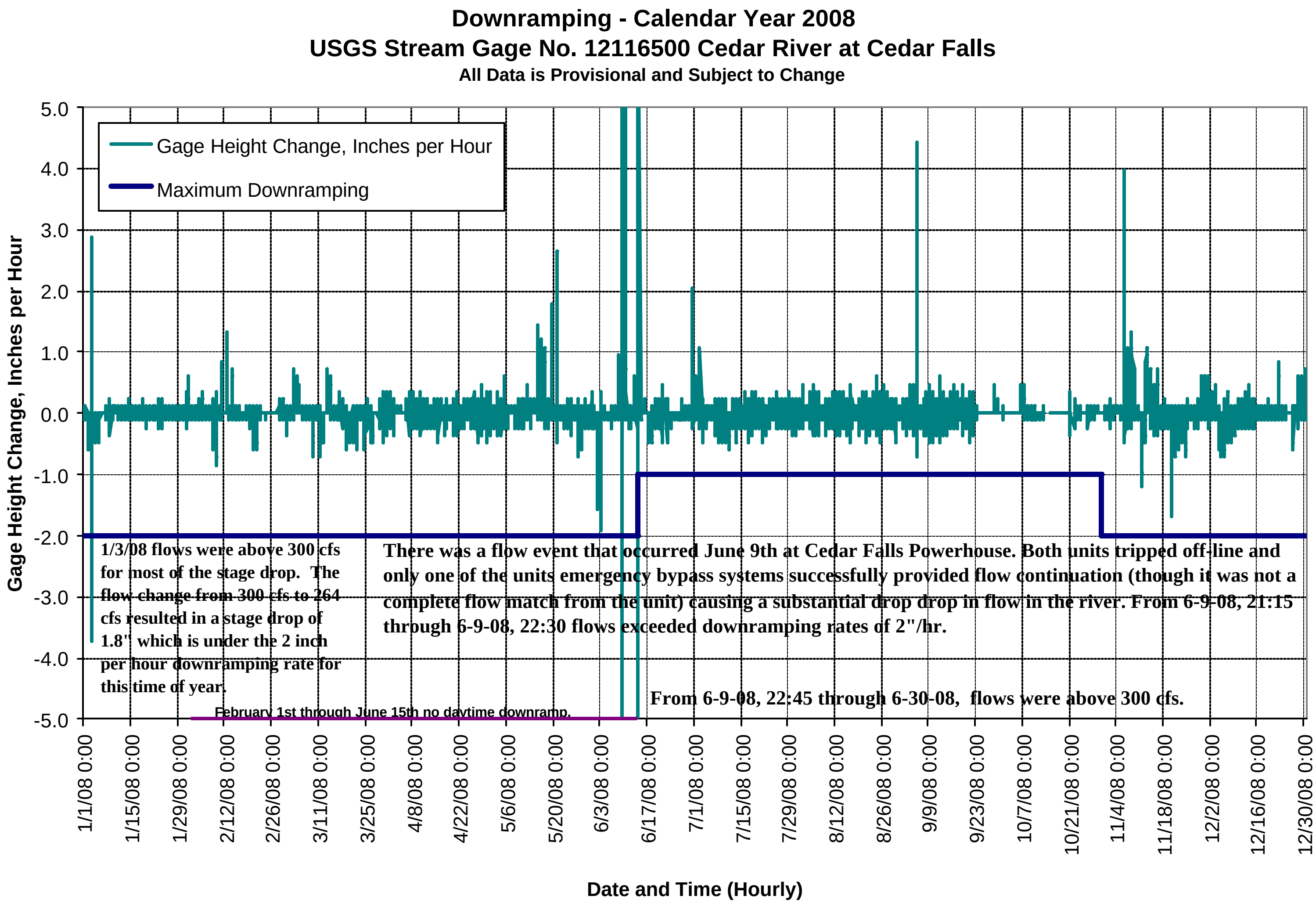


Figure 8.6 – Downramping Flows below Masonry Dam Compliance Graph

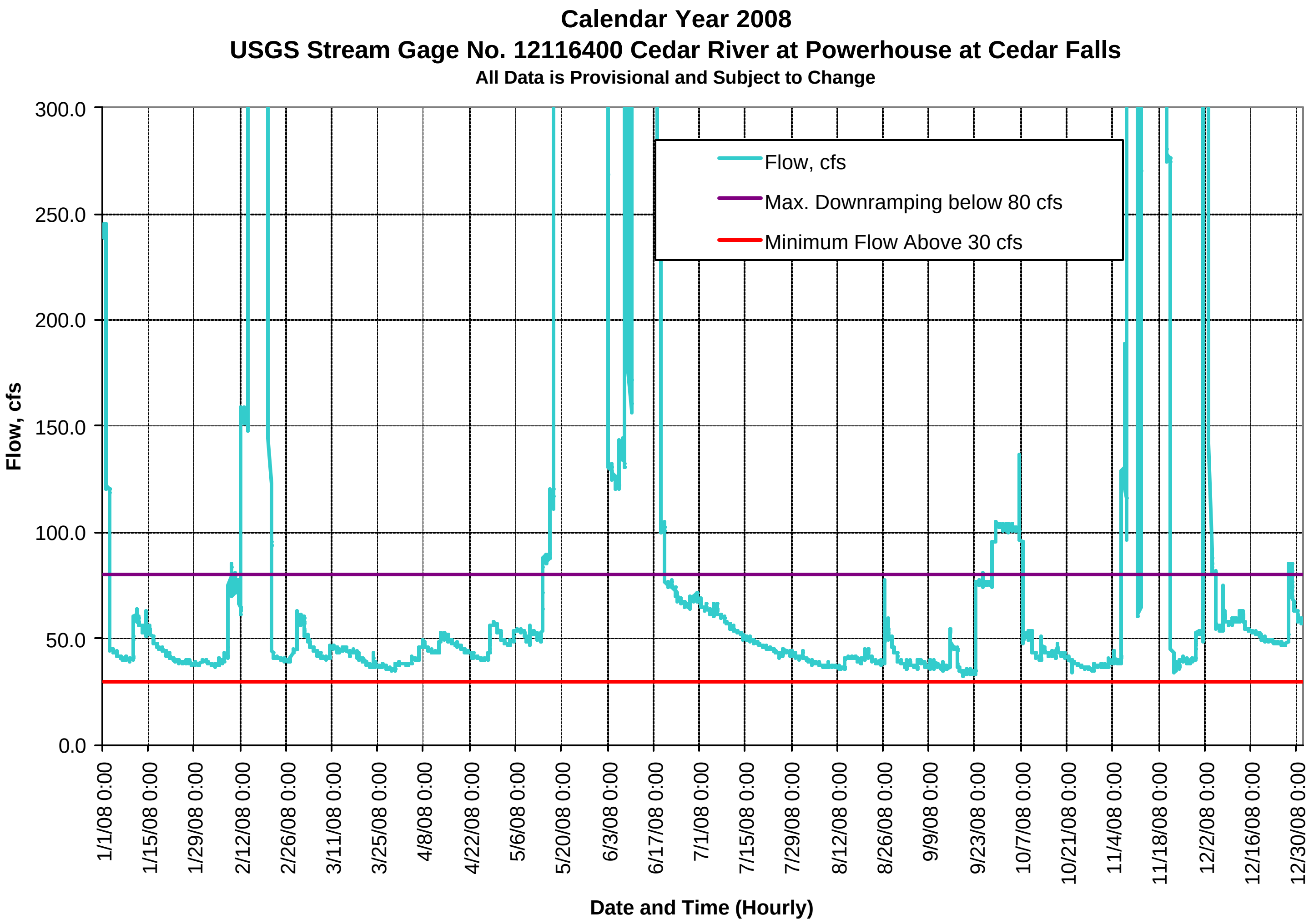


Figure 8.7 – Downramping Rate of Change Below Masonry Dam Compliance Graph

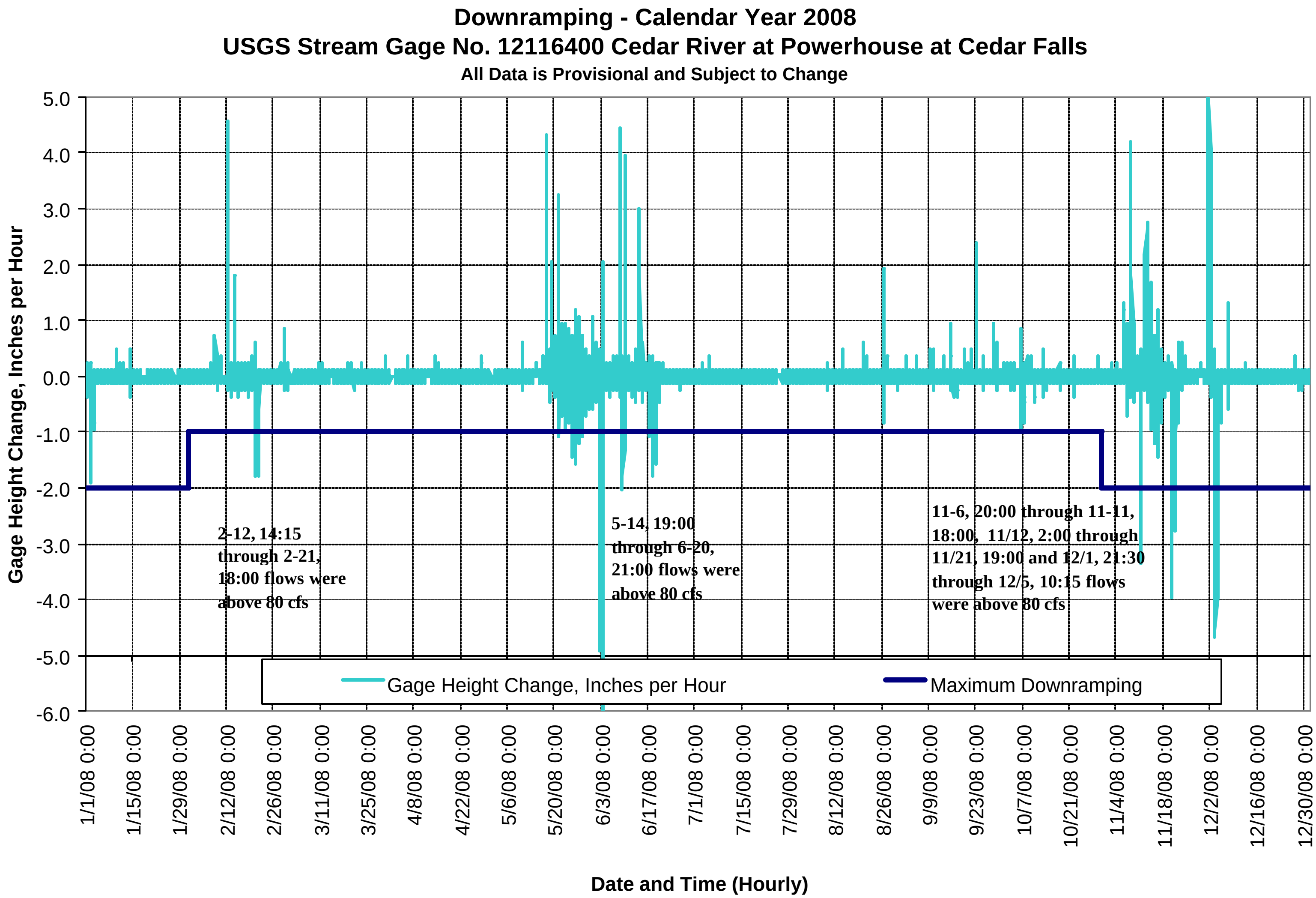


Table 8.1 – USGS 12117600 Mean Daily Flows

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
Date Processed: 2009-02-11
STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA
SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124* DATUM 490 NGVD29
Data is Provisional Real-Time - SPU Downloads Weekly
Discharge, cubic feet per second
CALENDAR YEAR JANUARY TO DECEMBER 2008
DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	780	320	813	384	353	1620	818	219	210	226	344	941
2	765	351	759	382	337	1530	864	241	203	247	368	1000
3	655	345	718	382	320	1230	927	257	201	297	404	1010
4	495	342	927	388	315	1040	896	247	197	307	423	974
5	361	366	942	395	331	1020	893	234	194	306	395	738
6	334	418	959	402	354	1080	911	223	195	298	514	507
7	333	555	951	441	360	1140	882	214	192	313	1380	503
8	337	537	949	452	367	1190	719	204	189	342	1150	499
9	336	907	882	429	396	1260	581	200	185	343	1330	433
10	404	851	711	419	439	1370	501	205	184	344	1300	392
11	589	839	746	423	525	1610	418	188	174	346	1120	384
12	528	940	564	425	519	1540	332	178	165	344	1580	400
13	506	977	685	460	528	1490	318	175	152	351	2080	435
14	490	901	946	447	632	1430	271	174	147	387	2040	440
15	486	1020	940	399	737	1310	253	177	156	357	1970	425
16	442	1000	925	395	1110	1340	248	175	155	360	1890	415
17	415	979	936	382	1350	1340	238	174	152	346	1820	417
18	397	958	965	375	1830	1200	227	197	144	367	1550	411
19	396	950	925	364	1730	1050	223	343	156	349	1440	401
20	390	937	780	347	2020	1060	219	400	192	346	1300	392
21	370	746	663	339	2280	987	210	415	231	348	1080	392
22	360	672	548	329	2690	978	195	366	230	347	863	416
23	347	664	547	325	2590	930	194	282	267	345	563	595
24	328	656	549	319	2530	808	195	245	264	345	477	605
25	312	653	488	311	2510	800	194	248	262	345	356	605
26	313	647	486	304	2490	799	196	261	239	345	357	572
27	314	645	423	305	2380	743	194	281	230	346	358	609
28	304	689	394	335	1880	692	192	242	226	343	357	851
29	306	697	392	379	1690	689	185	229	228	348	424	692
30	302	---	387	364	1670	782	193	218	228	343	630	655
31	317	---	383	---	1640	---	182	216	---	345	---	696
TOTAL	13012	20562	22283	11401	38903	34058	12869	7428	5948	10376	29863	17805
MEAN	420	709	719	380	1255	1135	415	240	198	335	995	574
MAX	780	1020	965	460	2690	1620	927	415	267	387	2080	1010
MIN	302	320	383	304	315	689	182	174	144	226	344	384
AC-FT	25809	40785	44198	22614	77164	67554	25526	14733	11798	20581	59233	35316

Table 8.2 – Instream Schedule with Firm and Non-Firm Flows

SEATTLE PUBLIC UTILITIES

OPERATIONAL MINIMUM INSTREAM FLOW SCHEDULE WITH FIRM AND NON-FIRM FLOWS

STATION NUMBER 12117600 CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA

SOURCE AGENCY SPU

LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124* DATUM 490 NGVD29

All Data is Provisional and Subject to Revision

Discharge, cubic feet per second

CALENDAR YEAR JANUARY TO DECEMBER 2008

DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	260	260	365	365	260	250	240	110	80	210	330	330
2	260	260	365	365	260	250	235	110	80	210	330	330
3	260	260	365	365	260	250	235	110	80	210	330	330
4	260	260	365	365	260	250	235	95	80	210	330	330
5	260	260	365	365	260	250	235	80	80	210	330	330
6	260	260	365	365	260	250	235	80	80	210	330	330
7	260	260	365	365	260	250	235	80	80	210	330	330
8	260	260	365	365	260	250	235	80	80	330	330	330
9	260	260	365	365	260	250	200	80	80	330	330	330
10	260	260	365	365	260	225	200	80	80	330	330	330
11	260	365	365	365	260	225	200	80	80	330	330	330
12	260	365	365	365	260	225	200	80	80	330	330	330
13	260	365	365	365	260	225	200	80	80	330	330	330
14	260	365	365	365	260	225	200	80	80	330	330	330
15	260	365	365	260	260	225	200	80	80	330	330	330
16	260	365	365	260	260	225	200	80	133	330	330	330
17	260	365	365	260	260	240	200	80	133	330	330	330
18	260	365	365	260	260	240	200	80	133	330	330	330
19	260	365	365	260	250	240	200	80	133	330	330	330
20	260	365	365	260	250	240	200	80	133	330	330	330
21	260	365	365	260	250	240	175	80	133	330	330	330
22	260	365	365	260	250	240	175	80	133	330	330	330
23	260	365	365	260	250	240	175	80	210	330	330	330
24	260	365	365	260	250	240	175	80	210	330	330	330
25	260	365	365	260	250	240	175	80	210	330	330	330
26	260	365	365	260	250	240	150	80	210	330	330	330
27	260	365	365	260	250	240	150	80	210	330	330	330
28	260	365	365	260	250	240	150	80	210	330	330	330
29	260	365	365	260	250	240	130	80	210	330	330	330
30	260	---	365	260	250	240	130	80	210	330	330	330
31	260	---	365	---	250	---	130	80	---	330	---	260
TOTAL	8060	9535	11315	9270	7930	7185	6000	2585	3811	9390	9900	10160
MEAN	260	329	365	309	256	240	194	83	127	303	330	328
MAX	260	365	365	365	260	250	240	110	210	330	330	330
MIN	260	260	365	260	250	225	130	80	80	210	330	260
AC-FT	15987	18912	22443	18387	15729	14251	11901	5127	7559	18625	19636	20152

Table 8.3 – USGS 12116500 Mean Daily Flows

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
Date Processed: 2008-02-17
STATION NUMBER 12116500 CEDAR RIVER AT CEDAR FALLS, WA
SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472502 LONGITUDE 1214727 NAD27 DRAINAGE AREA 84.2* DATUM 902.10 NGVD29
All Data is Provisional and Subject to Revision
Discharge, cubic feet per second
CALENDAR YEAR JANUARY TO DECEMBER 2008
DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	590	144	415	145	151	1410	702	88	91	124	202	723
2	556	180	409	144	151	1290	766	89	88	124	203	724
3	432	178	425	146	140	980	819	90	91	124	206	732
4	248	179	653	151	140	822	801	89	88	124	210	677
5	130	199	691	153	165	807	800	89	118	124	207	465
6	124	231	718	152	181	795	804	90	91	137	238	239
7	124	233	716	154	181	800	784	88	90	194	346	237
8	124	239	714	155	182	893	586	88	89	220	626	220
9	124	142	624	150	179	877	459	88	88	220	903	176
10	131	127	486	149	178	1000	362	88	89	221	891	139
11	145	198	462	152	182	1070	247	88	89	225	646	140
12	141	394	298	152	198	1040	172	87	88	221	359	140
13	139	499	329	159	204	1030	150	87	88	223	940	152
14	140	570	570	160	222	1020	103	89	86	225	1370	181
15	138	686	584	156	345	1080	101	93	101	226	1440	180
16	135	684	583	153	753	1080	100	92	97	226	1420	179
17	131	677	612	146	1080	1010	99	92	93	226	1400	179
18	132	671	657	146	1440	830	99	92	86	226	1260	177
19	135	667	611	144	1490	739	97	91	89	226	1240	177
20	130	639	471	137	1640	786	96	92	95	226	1050	175
21	131	446	377	133	1890	760	95	92	96	216	848	175
22	130	396	276	133	2090	766	93	91	98	200	637	237
23	131	397	274	127	2020	741	92	89	100	201	366	390
24	131	393	272	131	2010	720	93	88	99	201	293	392
25	129	392	224	131	2000	714	92	89	99	200	196	392
26	129	392	224	132	1960	e660	92	102	99	200	198	337
27	128	392	154	132	1820	e600	91	102	99	201	195	205
28	127	398	147	144	1490	578	91	98	103	201	195	228
29	129	399	143	159	1420	583	89	96	123	203	250	265
30	127	---	143	159	1400	641	88	93	124	204	455	324
31	131	---	145	---	1400	---	88	94	---	203	---	372
TOTAL	5372	11142	13407	4385	28702	26122	9151	2824	2875	6092	18790	9329
MEAN	173	384	432	146	926	871	295	91.1	95.8	197	626	301
MAX	590	686	718	160	2090	1410	819	102	124	226	1440	732
MIN	124	127	143	127	140	578	88	87	86	124	195	139
AC-FT	10660	22100	26590	8700	56930	51810	18150	5600	5700	12080	37270	18500

e Estimated

Table 8.4 – USGS 12116400 Mean Daily Flows

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
Date Processed: 2008-02-17
STATION NUMBER 12116400 CEDAR RIVER AT POWERPLANT AT CEDAR FALLS, WA
SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472508 LONGITUDE 1214649 NAD27 DRAINAGE AREA 83.9* DATUM 940 NGVD29
All Data is Provisional and Subject to Revision
Discharge, cubic feet per second
CALENDAR YEAR JANUARY TO DECEMBER 2008
DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	243	40	58	39	51	787	67	42	38	103	37	71
2	205	39	56	38	48	658	64	41	37	102	39	418
3	88	38	50	38	47	307	65	40	39	102	40	396
4	44	38	48	40	48	129	63	39	38	102	42	86
5	43	40	45	41	51	124	62	39	39	102	40	68
6	42	40	43	42	54	132	63	38	39	108	57	55
7	41	41	42	47	54	140	61	38	38	74	157	60
8	41	48	42	47	53	253	59	38	38	51	294	60
9	41	79	41	45	50	342	58	37	38	51	605	58
10	49	76	42	44	49	297	56	38	38	48	592	59
11	61	72	46	43	53	463	55	37	38	43	322	59
12	58	98	45	45	51	450	53	37	37	41	188	e59
13	55	154	44	52	50	442	52	37	38	42	749	60
14	55	227	45	52	70	453	51	39	37	43	1010	56
15	54	344	45	50	87	653	50	41	51	43	1070	54
16	50	338	43	49	100	649	50	42	46	43	798	53
17	47	331	44	47	324	585	49	42	42	42	744	53
18	45	325	43	47	689	374	48	41	35	44	621	52
19	44	321	41	46	745	172	47	39	35	43	611	50
20	43	291	40	45	894	98	46	42	35	42	410	50
21	42	87	39	43	1100	75	46	43	35	41	186	50
22	41	42	38	42	1340	76	45	41	34	38	40	49
23	40	41	39	42	1290	72	44	40	51	39	38	49
24	40	41	39	42	1300	69	43	39	77	38	38	48
25	39	40	37	41	1300	68	42	39	77	38	41	48
26	39	40	38	41	1300	67	e43	54	76	37	40	47
27	39	40	37	41	1190	66	44	53	76	37	40	65
28	39	44	36	47	875	67	43	48	80	36	40	76
29	39	49	36	57	821	69	43	45	103	38	47	66
30	38	---	38	54	812	69	42	42	103	38	54	60
31	40	---	39	---	798	---	41	39	---	38	---	58
TOTAL	1785	3404	1319	1347	15694	8206	1595	1270	1488	1687	8990	2493
MEAN	57.6	117	42.5	44.9	506	274	51.5	41	49.6	54.4	300	80
MAX	243	344	58	57	1340	787	67	54	103	108	1070	418
MIN	38	38	36	38	47	66	41	37	34	36	37	47
AC-FT	3540	6750	2620	2670	31130	16280	3160	2520	2950	3350	17830	4945

e Estimated

Table 8.5 – Seattle Public Utilities Chester Morse Lake Daily 7AM Elevation

SEATTLE PUBLIC UTILITIES
Date Processed: 2009-02-11
STATION NUMBER 12115900 CHESTER MORSE LAKE AT CEDAR FALLS, WA
SOURCE AGENCY SPU IWRMS
LATITUDE 472434 LONGITUDE 1214322 NAD27 DRAINAGE AREA 78.4*
All Data is Provisional and Subject to Revision
Water Surface Elevation, Feet
CALENDAR YEAR JANUARY TO DECEMBER 2008
Daily Readings Approximately 7 am

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	1550.15	1550.11	1548.40	1546.75	1552.29	1562.10	1564.45	1560.49	1556.45	1551.55	1548.70	1552.60
2	1549.55	1550.02	1548.90	1546.60	1552.55	1561.60	1564.50	1560.37	1556.34	1551.30	1548.50	1552.20
3	1549.16	1549.90	1549.10	1546.60	1552.85	1561.10	1564.45	1560.20	1556.25	1551.20	1548.55	1551.90
4	1548.85	1549.70	1549.30	1546.50	1553.10	1561.30	1564.45	1560.00	1556.09	1551.00	1548.60	1551.50
5	1548.50	1549.60	1549.25	1546.50	1553.47	1561.50	1564.15	1559.85	1556.96	1550.85	1548.60	1551.20
6	1548.45	1549.70	1549.02	1546.50	1554.02	1561.70	1563.79	1559.70	1555.78	1550.70	1548.60	1550.98
7	1548.35	1549.60	1548.65	1546.60	1554.68	1562.40	1563.51	1559.50	1555.65	1550.70	1550.00	1550.90
8	1548.35	1549.60	1548.20	1546.70	1555.03	1563.00	1563.11	1559.30	1555.49	1550.70	1552.00	1551.20
9	1548.30	1549.40	1547.80	1546.80	1555.49	1563.10	1562.85	1559.11	1555.38	1550.70	1552.00	1551.40
10	1548.29	1550.20	1547.40	1546.80	1555.85	1563.52	1562.71	1559.00	1555.14	1550.70	1551.65	1551.50
11	1548.50	1550.90	1547.35	1546.90	1556.32	1563.90	1562.61	1558.85	1555.10	1550.70	1551.30	1551.70
12	1549.08	1551.30	1547.50	1547.00	1556.81	1563.90	1562.60	1558.80	1555.05	1550.65	1551.91	1551.90
13	1549.57	1551.50	1547.68	1547.30	1557.22	1563.90	1562.52	1558.40	1554.85	1550.60	1559.59	1552.30
14	1549.95	1551.40	1547.90	1547.80	1557.74	1563.60	1562.50	1558.30	1554.69	1550.60	1560.90	1552.50
15	1550.35	1551.60	1547.92	1548.30	1559.25	1563.50	1562.48	1558.10	1554.50	1550.50	1560.36	1552.40
16	1550.59	1550.90	1547.90	1548.70	1560.85	1563.30	1562.43	1557.85	1554.30	1550.40	1559.40	1552.45
17	1550.70	1550.60	1547.65	1549.00	1562.92	1563.10	1562.35	1557.65	1554.10	1550.30	1558.40	1552.40
18	1550.75	1550.30	1547.44	1549.35	1564.71	1562.90	1562.27	1557.48	1553.95	1550.20	1558.20	1552.50
19	1550.72	1550.00	1547.11	1549.60	1565.85	1562.80	1562.18	1557.30	1553.70	1550.10	1556.30	1552.40
20	1550.79	1549.50	1546.90	1549.90	1566.43	1562.80	1562.08	1557.15	1553.53	1550.00	1555.10	1552.30
21	1550.75	1549.10	1546.65	1550.00	1566.98	1562.90	1561.98	1557.18	1553.40	1550.00	1554.50	1552.30
22	1550.75	1548.80	1546.50	1550.10	1566.95	1563.21	1561.85	1557.10	1553.29	1549.90	1553.90	1552.20
23	1550.62	1548.70	1546.35	1550.22	1566.30	1563.40	1561.72	1557.00	1553.10	1549.75	1553.52	1552.35
24	1550.63	1548.50	1546.47	1550.30	1565.35	1563.50	1561.55	1556.78	1552.95	1549.70	1553.30	1551.50
25	1550.48	1548.30	1546.47	1550.40	1564.43	1563.50	1561.44	1556.70	1552.70	1549.60	1553.10	1552.00
26	1550.35	1548.20	1546.46	1550.40	1563.86	1563.50	1561.29	1556.70	1552.60	1549.50	1553.02	1550.80
27	1550.50	1548.10	1546.50	1550.60	1563.48	1563.50	1561.15	1556.60	1552.45	1549.30	1552.90	1550.70
28	1550.30	1548.00	1546.55	1550.70	1563.30	1563.50	1561.01	1556.60	1552.38	1549.15	1552.76	1551.30
29	1550.18	1548.00	1546.59	1551.10	1563.30	1563.70	1560.85	1556.60	1552.10	1549.00	1552.75	1551.58
30	1550.22	---	1546.70	1551.80	1563.10	1564.10	1560.72	1556.55	1551.81	1548.90	1552.45	1551.65
31	1550.20	---	1546.66	---	1562.70	---	1560.58	1556.50	---	1548.70	---	1551.48
MEAN	1549.80	1549.71	1547.52	1548.53	1559.91	1562.99	1562.46	1558.12	1554.34	1550.22	1553.36	1551.81
MAX	1550.79	1551.60	1549.30	1551.80	1566.98	1564.10	1564.50	1560.49	1556.96	1551.55	1560.90	1552.60
MIN	1548.29	1548.00	1546.35	1546.50	1552.29	1561.10	1560.58	1556.50	1551.81	1548.70	1548.50	1550.70

Table 8.6 – USGS 12115000 Mean Daily Flows

U.S. DEPARTMENT OF THE INTERIOR - U.S. GEOLOGICAL SURVEY - WATER RESOURCES
Date Processed: 2009-02-11
STATION NUMBER 12115000 CEDAR RIVER NEAR CEDAR FALLS, WA
SOURCE AGENCY USGS STATE 53 COUNTY 033
LATITUDE 472213 LONGITUDE 1213726 NAD27 DRAINAGE AREA 40.7* DATUM 1560.00 NGVD29
All Data is Provisional and Subject to Revision
Discharge, cubic feet per second
CALENDAR YEAR JANUARY TO DECEMBER 2008
DAILY MEAN VALUES

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	121	134	172	340	308	540	323	52	36	77	116	105
2	432	128	159	311	323	583	292	50	35	157	107	106
3	879	125	158	287	322	643	263	49	34	304	102	706
4	578	126	164	273	301	718	236	49	38	187	100	1170
5	422	134	180	263	271	749	211	48	37	140	94	836
6	413	172	207	271	252	823	183	47	35	119	89	535
7	536	218	260	347	270	856	155	47	34	159	84	393
8	596	250	308	411	375	830	134	51	34	186	81	313
9	483	251	302	479	447	775	118	48	33	157	79	264
10	427	242	302	423	387	793	104	46	33	138	115	231
11	348	252	764	356	359	821	95	45	32	127	100	204
12	292	243	1630	308	356	802	90	44	32	116	143	187
13	258	227	953	286	356	756	87	43	32	105	182	175
14	228	222	598	279	309	694	83	42	32	96	157	166
15	204	560	443	274	333	646	79	42	32	90	154	160
16	189	874	378	266	415	611	77	41	32	87	333	152
17	177	625	380	266	394	615	75	41	37	85	377	144
18	167	552	607	264	361	614	75	40	40	84	390	142
19	166	513	640	261	349	590	75	42	36	127	320	163
20	166	638	587	257	338	565	74	48	34	174	263	174
21	150	456	473	255	349	536	72	49	34	244	223	151
22	151	363	407	255	336	511	70	46	34	312	195	140
23	159	304	397	252	322	489	68	42	33	316	175	166
24	167	266	1510	252	330	469	66	40	32	277	160	215
25	172	240	1850	256	352	475	62	39	32	249	147	180
26	169	217	902	271	377	438	60	40	31	208	137	164
27	164	197	624	280	410	415	58	39	31	183	134	149
28	158	186	487	346	416	388	56	38	38	164	124	143
29	152	186	404	365	406	375	55	37	41	148	117	134
30	146	---	361	323	445	356	55	36	42	135	110	128
31	141	---	354	---	501	---	53	36	---	124	---	119
TOTAL	8811	8715	16961	9077	11070	18476	3504	1357	1036	5075	4908	8015
MEAN	284	311	547	303	357	616	113	43.8	34.5	164	164	259
MAX	879	874	1850	479	501	856	323	52	42	316	390	1170
MIN	121	125	158	252	252	356	53	36	31	77	79	105
AC-FT	17480	17290	33640	18000	21960	36650	6950	2690	2050	10070	9740	15900
CFSM	6.98	7.65	13.4	7.43	8.77	15.1	2.78	1.08	0.85	4.02	4.02	6.35
IN.	8.05	7.97	15.5	8.3	10.12	16.89	3.2	1.24	0.95	4.64	4.49	7.33

Table 8.7 – Seattle Public Utilities Landsburg Daily Diversion

SEATTLE PUBLIC UTILITIES
Date Processed: 2009-02-11
LANDSBURG TUNNEL - FLOW VOL 24 HR TOT - MG
SOURCE AGENCY SPU IWRMS
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124* DATUM 490 NGVD29
All Data is Provisional and Subject to Revision
Flow Volume, Million Gallons
CALENDAR YEAR JANUARY TO DECEMBER 2008
24 Hour Total

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	78.40	89.00	64.50	72.50	109.10	128.40	125.90	111.70	98.70	85.10	56.50	57.50
2	79.50	89.50	79.50	67.50	107.10	126.50	120.60	85.00	99.10	57.30	59.00	58.20
3	78.00	88.80	78.80	67.00	109.70	127.00	117.90	79.80	98.20	40.10	58.50	58.20
4	79.40	88.10	89.90	77.50	108.20	124.90	117.70	85.00	101.00	40.50	59.10	58.00
5	79.70	88.70	100.50	80.70	107.40	126.60	118.50	89.30	115.60	40.00	59.60	58.20
6	79.80	58.80	98.40	80.80	107.60	126.20	117.70	98.60	100.60	50.50	31.30	58.70
7	70.60	11.90	99.20	80.30	108.10	126.60	117.50	100.10	101.90	70.40	0.00	58.00
8	69.50	44.70	94.40	80.00	88.70	124.50	118.10	109.10	101.00	68.40	0.00	57.80
9	69.30	0.00	99.00	81.60	72.00	112.20	118.10	109.20	98.50	66.70	0.00	65.60
10	62.80	0.00	97.70	80.70	17.00	89.20	106.80	109.00	102.80	66.70	0.00	68.70
11	69.30	0.00	98.70	80.00	0.00	70.10	99.70	117.00	108.80	69.60	0.00	68.70
12	70.00	0.30	74.20	81.10	0.00	69.70	101.00	118.80	112.30	65.90	0.00	60.80
13	69.10	60.10	0.30	79.70	0.00	70.00	100.50	120.30	121.60	66.50	0.00	58.00
14	69.20	80.70	32.00	100.60	0.00	80.00	104.60	119.30	120.80	69.00	0.00	57.40
15	69.40	81.10	51.20	118.30	0.00	78.30	109.70	119.20	121.40	68.90	2.70	56.80
16	69.30	81.50	49.90	104.50	32.90	76.30	109.70	122.00	118.80	75.80	0.00	57.60
17	69.60	81.00	68.50	100.80	48.70	19.60	116.90	119.90	120.20	76.90	32.60	57.20
18	68.80	80.30	80.40	100.20	27.50	0.00	119.80	74.90	118.50	80.00	98.30	57.50
19	70.40	80.10	79.90	100.70	70.50	0.00	119.10	0.00	108.60	78.80	118.30	57.60
20	68.90	79.90	77.70	99.20	5.50	0.00	120.90	0.00	96.30	78.20	118.50	57.90
21	68.90	78.90	77.20	98.70	0.40	0.00	125.70	9.00	85.20	68.30	117.70	57.70
22	69.20	78.70	81.50	100.10	0.00	0.00	130.50	17.70	69.10	58.30	120.00	57.00
23	77.10	79.40	79.50	99.40	0.00	46.20	127.50	59.60	50.50	58.70	117.60	57.80
24	86.00	78.80	78.80	98.10	0.00	87.40	131.80	77.70	50.50	56.60	117.50	57.60
25	88.60	77.00	79.50	98.10	0.00	88.90	125.40	84.60	71.50	54.10	117.70	57.50
26	90.30	79.20	79.70	100.70	0.00	89.60	124.00	95.90	74.30	52.60	104.90	57.60
27	88.80	78.70	80.10	99.80	29.50	129.50	127.00	99.60	75.10	50.20	100.30	19.60
28	88.50	78.60	79.50	105.80	92.60	153.10	126.30	99.30	76.80	51.60	98.90	8.00
29	88.70	71.20	78.80	110.10	128.10	153.30	129.70	99.00	84.70	48.00	100.40	57.80
30	88.60	---	77.00	109.20	126.90	150.60	129.20	98.90	85.40	51.20	93.30	60.40
31	89.30	---	75.30	---	130.50	---	130.50	100.00	---	56.80	---	59.90
TOTAL	2365.0	1885.0	2381.6	2753.7	1628.0	2574.7	3688.3	2729.5	2887.8	1921.7	1782.7	1739.3
MEAN	76.3	65.0	76.8	91.8	52.5	85.8	119.0	88.0	96.3	62.0	59.4	56.1
MAX	90.3	89.5	100.5	118.3	130.5	153.3	131.8	122.0	121.6	85.1	120.0	68.7
MIN	62.8	0.0	0.3	67.0	0.0	0.0	99.7	0.0	50.5	40.0	0.0	8.0

Average Calendar Year 2007 Diversion: 77.42

Table 8.8 – Seattle Public Utilities Landsburg 24 Hour Total Precipitation

SEATTLE PUBLIC UTILITIES
Date Processed: 2009-02-11
LANDSBURG WEATHER STATION - PRECIP 24HR TOT
SOURCE AGENCY SPU IWRMS
LATITUDE 472247 LONGITUDE 1215856 NAD27 DRAINAGE AREA 124* DATUM 490 NGVD29
All Data is Provisional and Subject to Revision
Rainfall, Inches
CALENDAR YEAR JANUARY TO DECEMBER 2008
24 Hour Total

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.00	0.13	0.26	0.05	0.01	0.00	0.00	0.34	0.00	0.00	0.27	0.25
2	0.42	0.06	0.05	0.00	0.00	0.00	0.50	0.00	0.00	0.05	0.69	0.30
3	0.18	0.04	0.11	0.00	0.03	0.62	0.20	0.00	0.00	0.32	0.35	0.02
4	0.02	0.08	0.06	0.65	0.00	0.10	0.04	0.00	0.00	0.24	1.00	0.00
5	0.05	0.38	0.00	0.05	0.00	0.18	0.27	0.00	0.00	0.07	0.02	0.00
6	0.15	0.27	0.02	0.52	0.00	0.77	0.05	0.00	0.00	0.29	2.95	0.00
7	0.13	0.18	0.07	0.27	0.04	0.07	0.00	0.00	0.00	0.11	1.14	0.45
8	0.43	1.56	0.00	0.41	0.00	0.02	0.00	0.00	0.00	0.00	0.16	0.04
9	0.20	0.30	0.00	0.07	0.00	0.43	0.00	0.40	0.00	0.16	0.16	0.06
10	1.12	0.63	0.35	0.17	0.32	0.42	0.00	0.00	0.00	0.00	0.03	0.26
11	0.22	0.08	0.21	0.01	0.06	0.08	0.00	0.00	0.00	0.00	0.50	0.00
12	0.25	0.08	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	2.23	1.12
13	0.04	0.02	0.50	0.12	0.64	0.00	0.00	0.00	0.00	0.57	0.12	0.29
14	0.32	0.00	0.53	0.64	0.12	0.00	0.00	0.00	0.00	0.01	0.00	0.04
15	0.00	0.10	0.17	0.33	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00
16	0.00	0.02	0.41	0.01	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00
17	0.00	0.00	0.04	0.02	0.00	0.00	0.00	0.03	0.00	0.39	0.00	0.14
18	0.00	0.00	0.04	0.03	0.00	0.00	0.00	0.09	0.01	0.13	0.04	0.13
19	0.40	0.00	0.19	0.20	0.03	0.00	0.00	0.34	0.00	0.00	0.00	0.00
20	0.04	0.00	0.14	0.10	0.85	0.00	0.00	1.00	0.84	0.20	0.27	0.20
21	0.00	0.00	0.00	0.08	1.20	0.00	0.00	0.36	0.41	0.00	0.07	0.35
22	0.00	0.12	0.00	0.10	0.12	0.11	0.00	0.00	0.09	0.00	0.01	0.04
23	0.00	0.00	0.50	0.10	0.05	0.00	0.00	0.00	0.00	0.06	0.00	0.00
24	0.00	0.01	0.00	0.05	0.05	0.00	0.00	0.30	0.08	0.00	0.00	0.70
25	0.00	0.04	0.02	0.00	0.02	0.00	0.00	0.52	0.48	0.00	0.29	0.24
26	0.50	0.00	0.82	0.00	0.01	0.00	0.00	0.12	0.01	0.00	0.01	0.17
27	0.07	0.26	0.02	0.08	0.00	0.00	0.00	0.52	0.00	0.00	0.07	1.28
28	0.20	0.17	0.32	0.42	0.06	0.00	0.00	0.04	0.00	0.00	0.14	0.58
29	0.19	0.64	0.18	0.22	0.01	0.12	0.48	0.00	0.00	0.00	0.20	0.32
30	0.13	---	0.32	0.18	0.00	0.00	0.01	0.00	0.01	0.02	0.07	0.10
31	0.53	---	0.11	---	0.00	---	0.08	0.06	---	0.50	---	0.13
TOTAL	5.59	5.17	5.44	4.88	3.64	2.92	1.63	4.12	1.93	3.48	10.79	7.21
MEAN	0.18	0.18	0.18	0.16	0.12	0.10	0.05	0.13	0.06	0.11	0.36	0.23
MAX	1.12	1.56	0.82	0.65	1.20	0.77	0.50	1.00	0.84	0.57	2.95	1.28
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 8.9 – Seattle Public Utilities Masonry Dam 24 Hour Precipitation

SEATTLE PUBLIC UTILITIES
Date Processed: 2009-02-11
MASONRY WEATHER STATION - PRECIP 24HR TOT
SOURCE AGENCY SPU IWRMS
LATITUDE 472443 LONGITUDE 1214504 NAD27 DRAINAGE AREA 78.4* DATUM 490 NGVD29
All Data is Provisional and Subject to Revision
Rainfall, Inches
CALENDAR YEAR JANUARY TO DECEMBER 2008
24 Hour Total

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	0.27	0.36	1.44	0.00	0.00	0.07	0.00	0.20	0.00	0.00	0.82	0.52
2	0.40	0.01	0.00	0.00	0.00	0.22	0.40	0.06	0.00	0.10	1.13	0.32
3	0.26	0.16	0.84	0.00	0.06	0.96	0.15	0.00	0.00	0.41	0.78	0.00
4	0.17	0.41	0.00	0.72	0.00	0.12	0.07	0.00	0.00	0.59	0.25	0.00
5	0.19	0.64	0.00	0.31	0.00	0.82	0.80	0.00	0.00	0.07	0.50	0.00
6	0.35	0.91	0.00	0.92	0.10	1.71	0.00	0.00	0.00	0.52	3.87	0.44
7	0.38	0.34	0.29	0.76	0.00	0.11	0.00	0.00	0.00	0.01	0.85	1.33
8	0.31	2.85	0.00	0.27	0.00	0.01	0.00	0.02	0.00	0.00	0.16	0.09
9	1.05	1.02	0.00	0.11	0.00	2.41	0.00	0.26	0.00	0.02	0.50	0.31
10	1.79	0.33	0.76	0.00	0.63	1.10	0.00	0.08	0.00	0.00	0.36	0.35
11	0.58	0.09	0.36	0.00	0.18	0.02	0.00	0.00	0.00	0.00	2.77	0.00
12	1.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	3.15	1.60
13	0.00	0.00	0.55	0.12	0.93	0.20	0.00	0.00	0.00	1.43	0.30	0.28
14	1.39	0.00	0.68	0.82	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.35	0.34	0.88	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00
16	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.12
17	0.00	0.00	0.22	0.32	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.80
18	0.09	0.00	0.23	0.26	0.00	0.00	0.00	0.18	0.02	0.07	0.18	0.56
19	0.84	0.00	0.35	0.19	0.69	0.00	0.00	1.21	0.16	0.01	0.00	0.00
20	0.11	0.00	0.28	0.27	0.83	0.00	0.00	1.54	0.77	0.41	0.73	0.39
21	0.00	0.00	0.00	0.10	0.63	0.16	0.00	0.33	0.09	0.00	0.24	0.26
22	0.00	0.00	0.15	0.22	0.26	0.03	0.00	0.00	0.05	0.00	0.00	0.00
23	0.00	0.00	0.96	0.23	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.24
24	0.00	0.03	0.00	0.33	0.04	0.00	0.00	0.63	0.76	0.00	0.00	0.95
25	0.00	0.05	0.50	0.00	0.00	0.00	0.00	1.86	0.20	0.00	0.53	0.42
26	0.80	0.02	0.47	0.00	0.08	0.00	0.00	0.83	0.00	0.00	0.00	1.40
27	0.36	0.50	0.09	0.13	0.00	0.00	0.00	0.08	0.00	0.00	0.29	1.99
28	0.90	0.07	0.69	1.24	0.07	0.00	0.00	0.10	0.00	0.01	0.65	0.22
29	0.50	1.71	0.78	0.77	0.02	0.00	0.60	0.00	0.00	0.00	0.44	0.05
30	0.43	---	0.12	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.31
31	0.85	---	0.46	---	0.03	---	0.87	0.23	---	0.47	---	1.07
TOTAL	13.02	10.16	11.20	9.42	4.79	7.94	2.89	7.61	2.05	5.26	18.52	14.02
MEAN	0.42	0.35	0.36	0.31	0.15	0.26	0.09	0.25	0.07	0.17	0.62	0.45
MAX	1.79	2.85	1.44	1.24	0.93	2.41	0.87	1.86	0.77	1.43	3.87	1.99
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00